transpogroup
WHAT TRANSPORTATION CAN BE.

# MEMORANDUM

| | | | |
|---|---|---|---|
| **Date:** | June 2, 2020 | **TG:** | 15516.00 |
| **To:** | Tawni Dalziel, PE – City of Maple Valley | | |
| **From:** | Jon Pascal, PE, PTOE - Transpo Group | | |
| **Subject:** | Maple Valley Travel Demand Model Update and Residential Land Use Analysis for the City's Commercial Mixed-use Areas | | |

## Background

This memorandum has been prepared to summarize and present the results of updating the City's travel demand model to reflect changes in recent development activity, land use regulations, and transportation improvements within the City. The update also incorporated land use changes in neighboring jurisdictions since the last major model update was completed in 2015 as part of the Comprehensive Plan. The revised travel model provides improved clarity on changes in future transportation performance in the City and provides the City the capability to test potential changes in land use and zoning regulations.

As part of the work program, an alternative land use scenario was evaluated using the updated model to understand the future change in transportation system performance with the reduction of future residential development in the mixed-use commercial areas of the City. The model was utilized to evaluate the resulting travel forecasts and intersection levels of service without additional residential development and compare the results against the updated model scenario, which assumed residential would be allowed. The updated model scenario is consistent and supportive of the land use regulations identified in the City's adopted Comprehensive Plan, which allow residential mixed-use development within the City's commercially zones areas.

## Key Findings

The key findings of this work effort include the following:

**Model / Land Use Update**

Updated land use forecasts were incorporated into the travel demand model to evaluate the change in future transportation system performance as compared to the previous travel forecasts completed as part of the Comprehensive Plan update in 2015.

- The updated land use forecasts show a decreased level of development occurring in both the Cities of Black Diamond and Covington than had been assumed during development of Maple Valley's Comprehensive Plan due to a lengthened timeline for buildout.
- Land use forecasts within the City of Maple Valley show a decrease in density in the Regional Employment Center in the northern part of the City due to changes in the type and intensity of planned development in the Hayes Pit area.
- Both the Community Business District and the Town Center areas are expected to have increased level of development compared to the Comprehensive Plan land use assumptions based on recent mixed-use development patterns in the City.
- As a result of the land use updates and refinements, traffic forecasts are not expected to grow as significantly as compared to the prior forecasts developed as part of the Comprehensive Plan.
- Forecast year 2035 PM peak hour intersection levels of service (LOS) are similar to estimates in the Comprehensive Plan. No additional capital investments beyond those on the City's 20-year transportation project list are needed to maintain adopted transportation performance standards.

**Without Additional Residential Land Use Allowed in TC/CB Zones**

The work effort also evaluated the differences in transportation system performance by removing additional forecast growth in residential development in the TC/CB zones and Legacy site zone.

- Approximately 1,114 future residential units would not be built by 2035 if the residential moratorium was made permanent in the TC/CB zones in the City.
- With the reduction in residential growth in the commercial zones, PM peak hour traffic forecasts are not expected to change significantly at major study intersections throughout the City. The analysis showed that the traffic volumes were generally within one percent of each other.
- Since the traffic forecasts are not estimated to change greatly with the reduction in residential growth in the TC/CB zones and Legacy site, forecast year 2035 PM peak hour intersection LOS is also not expected to change significantly. The only intersection expected to operate at an improved LOS is the intersection of SR 169 and SR 516. It is forecast to operate at LOS F under the 2035 with residential allowed, and at LOS E under the without residential conditions. However, the difference in average vehicle delay between the two land use scenarios is only 2 seconds since the intersection delay bordered the LOS E/F threshold.

# Travel Model Overview

A travel demand forecasting model is currently maintained by the City to assist in defining and evaluating future transportation system needs and testing land use scenarios. The model was constructed as part of the Transportation Element update in 2015. The model uses the VISUM software package and forecasts weekday PM peak hour traffic volumes based on the land use plan identified within the Comprehensive Plan. The model study area includes Black Diamond, Covington, and parts of Kent and unincorporated King County. The model is comprised of Transportation Analysis Zones (TAZs), which are used to summarize land use and assign trips to the transportation system. The model has 335 lane miles coded that represent arterials, collectors, and local streets. Trip generation is based on the number of daily trips by various land uses such as residential, commercial, industrial, etc. The daily trips produced by land use is converted to peak hour trips using time-of-day factors. The model represents the PM peak hour period (one-hour volume) between 4 p.m. and 6 p.m. on a typical weekday, which has historically had the greatest number of trips on the transportation system.

The model was calibrated to match existing base year traffic volumes (2020) and then used to develop a 2035 traffic forecast. City, County, and State transportation improvement projects likely to be funded and built by 2035 were included in the future baseline model. The improvements were defined based on local agency Transportation Improvement Programs and the PSRC's Transportation 2040 Plan compilation of regional projects. To understand the future transportation performance, the 2035 model includes City projects identified in the adopted Comprehensive Plan. The projects were input into the travel demand model and the 2035 forecasts were prepared. Included as attachments are **Error! Reference source not found.** which shows the TAZ boundaries within the City of Maple Valley, and **Error! Reference source not found.** which shows the 2035 travel model network.

# Travel Model Update to Horizon Year 2035

This section summarizes the transportation network assumptions and land use updates incorporated into the travel model, and the resulting traffic operations analysis based on outputs from the model. To account for changes in land use since the model was last updated in 2015, the model land use forecasts were refined and reconfirmed based on development patterns over the last 5 years in the City and its surrounding jurisdictions. In addition, the horizon year was extended from 2030 to 2035 to capture an extended period of growth over the next 15 years. The updated

model continues to be consistent with the City adopted land use plan and zoning regulations. It is important to note that the 2035 land use forecasts allow for residential mixed-use development in the TC/CB and Legacy Site zones, consistent with the existing Comprehensive Plan. Another model scenario is presented later in the memorandum that removes additional residential land uses assumed in the TC/CB and Legacy Site zones to understand the change in transportation system performance.

## *Transportation System Assumptions*

The updated model includes future transportation system investments to achieve adopted LOS performance standards, as identified in the City's Comprehensive Plan. The model assumes all projects identified on the City's long-term project list will be implemented by 2035, consistent with the City's Comprehensive Plan. The key project assumptions that are contained in the model include the completion of all the City's currently funded 6-year Transportation Improvement Program projects, along with the following longer-term projects:

- Dual westbound left turn lanes at the intersection of Witte Road and SE 240th Street
- The completion of the 5-lane cross-section along SR 169 between north City limits and SE 280th Street
- SR 516 widened to 5 lanes west of SE 216th Avenue through the City of Covington
- The SE 240th Street extension from Witte Road SE to SE Wax Road (west leg of SE 240th Street/ Witte Road intersection) is completed by 2035

It is recognized that no funding plan is identified to construct the projects listed above, but the Comprehensive Plan currently assumes the City will complete the projects at some point in the future. Additionally, the City is collecting traffic impact fees that could be used to help fund the improvements in the future.

## *Land Use Forecast Updates*

Table 1 summarizes the land use updates incorporated into the 2035 travel demand model and compares them to the land use forecasts contained in the previous 2030 model. The land use data has been summarized for key areas in and outside of Maple Valley to illustrate the major changes in the assumptions.

As previously mentioned, the updated model assumes multi-family residential is allowed in the TC/CB and Legacy Site zones. The approximate density and number of residential units was determined by evaluating recent mixed-use development proposals in the City. For example, existing develop densities for the Pallis Properties and Marques development were reviewed, along with a proposal for the Bitney property. The residential and commercial square footage densities were then utilized to estimate potential development sizes for the remaining undeveloped or under-developed properties in the TC/CB and Legacy Site zones.

**Table 1. 2035 Update vs Previous 2030 Land Use Forecasts**

| | 2030 Model | | 2035 Updated Model | | Change from 2030 | |
|---|---|---|---|---|---|---|
| Land Use / Location | Residential Units | Employees | Residential Units | Employees | Residential Units | Employees |
| Community Business[1] | 546 | 1,315 | 754 | 1,437 | 208 | 122 |
| Regional Employment Center[2] | 2 | 1,463 | 2 | 648 | 0 | -815 |
| Town Center | 354 | 1,488 | 738 | 1,667 | 384 | 179 |
| Legacy Site | 80 | 526 | 240 | 365 | 160 | -161 |
| Regional Learning and Tech Center | 0 | 583 | 0 | 583 | 0 | 0 |
| City of Black Diamond[3] | 8,092 | 3,798 | 5,964 | 3,781 | -2,128 | -17 |
| City of Covington[3] | 10,692 | 7,173 | 10,318 | 6,846 | -374 | -327 |

1. CB consists of 8 TAZs at the north end of the City (around SE 240th Street between Witte Road and residential land use by western City limits)
2. REC includes 3 TAZs in the north end of the City, just north of the Community Business district in the vicinity of the 231st Street extension.
3. Does not include entire City, just major developments that are within the travel demand model extents.

As shown in Table 1, the largest difference between the 2030 and the 2035 land use forecasts occurs south of Maple Valley in the City of Black Diamond. Specifically, the Lawson Hills / Ten Trails development within Black Diamond is currently under construction with a largely decreased number of residential units expected to be completed by 2035 based on available information from the City of Black Diamond. The City of Covington also is expected to have a slightly decreased number of both residential units and employees than originally forecast. While reduced number of residential units is shown as a reduction, it is likely that full buildout of each development will occur sometime after 2035 to match against market demands.

Within the City of Maple Valley, the largest change comes in the Regional Employment Center area in the north part of the City. The original land use forecasts in that area expected large amounts of office and retail space in the Hayes Pit area, but current development proposals instead focus on industrial and warehouse uses which result in much lower trip generation values. Both the Community Business land uses at the north end of the city and the Town Center area are expected to have more mixed-use type of development, with a mix of residential and commercial development than had been originally forecast for 2030. Finally, the Legacy Site is forecast to develop with more residential units and fewer jobs than expected in the previous 2030 forecasts based on the type of development that has been occurring in the City, as previously summarized.

## *Traffic Forecasts*

This section summarizes the PM peak hour traffic forecasts from the updated 2035 Maple Valley travel demand model. The study intersections were identified within the Maple Valley Transportation Element of the Comprehensive Plan as the major intersections along key corridors (SR 169, SR 516, and Witte Road). The study intersections used in the Comprehensive Plan were used again in this analysis to allow for comparison back to previous estimates. Table 2 shows the PM peak hour total entering volume (TEV) at each study intersection in Maple Valley for the updated 2035 model and compares it to the previous 2030 forecasts from the Transportation Element.

**Table 2. PM Peak Hour Intersection Volumes - 2035 Update vs Previous 2030 Model**

| Intersection | Previous 2030 TEV | 2035 TEV[1] | Change (2030 – 2035) | % Change (2030-2035) |
|---|---|---|---|---|
| 1. SR 169 / SE 231st St | 4,935 | 4,240 | -695 | -14% |
| 2. SR 169 / SE Wax Rd | 4,095 | 3,760 | -335 | -8% |
| 3. SR 169 / Witte Rd SE | 3,895 | 3,900 | 5 | 0% |
| 4. Witte Rd SE / SE 240th St | 2,745 | 2,405 | -340 | -12% |
| 5. SR 169 / SE 240th St | 3,750 | 3,535 | -215 | -6% |
| 6. 216th Ave SE / SR 516 | 3,465 | 3,165 | -300 | -9% |
| 7. Witte Rd SE / SR 516 | 3,135 | 3,150 | 15 | 0% |
| 8. 228th Ave SE / SR 516 | 2,940 | 2,925 | -15 | -1% |
| 9. SR 169 / SR 516 | 4,180 | 4,180 | 0 | 0% |
| 10. SR 169 / SE 271st St | 3,480 | 3,640 | 160 | 5% |
| 11. SR 169 / SE 280th St | 2,675 | 2,735 | 60 | 2% |
| 12. SR 169 / SE 244th St | 3,530 | 3,255 | -275 | -8% |
| 13. SR 169 / SE 251st St | 3,410 | 3,070 | -340 | -10% |
| 14. SR 169 / SE 264th St | 3,865 | 3,685 | -180 | -5% |
| 15. Witte Rd SE / SE 248th St | 1,965 | 2,075 | 110 | 6% |
| 16. Witte Rd SE / SE 254th Pl | 1,405 | 1,485 | 80 | 6% |
| 17. Witte Rd SE / SE 268th St | 1,410 | 1,400 | -10 | -1% |
| 18. SR 18 NB Ramps / SE 231st St | 3,210 | 3,185 | -25 | -1% |
| 19. SR 18 SB Ramps / SE 231st St | 3,095 | 3,080 | -15 | 0% |
| 21. SR 169 / SE 276th St | 3,140 | 3,080 | -60 | -2% |
| 25. SE Kent-Kangley Rd / 242nd Ave SE | 1,620 | 1,760 | 140 | 9% |

1. Total Entering Volume during the weekday PM peak hour.

As shown in Table 2, forecast traffic volumes decreased at most of the study intersections in Maple Valley due to a general reduction in projected development. Intersection volumes decreased most significantly at the north end of Maple Valley along SR 169 and Witte Road primarily due to development in the north end (Maple Valley Business Park) being of much lower intensity than originally expected.

## *Traffic Operations*

Based on the PM peak hour intersection forecast volumes, Table 3 summarizes traffic operations for the future 2035 update compared to the previous 2030 analysis included in the Transportation Element.

The operational characteristics of an intersection are determined by calculating the intersection level of service (LOS). At unsignalized side-street, stop-controlled intersections, LOS is measured by the average delay on the worst-movement of the intersection. Traffic operations and average vehicle delay for an intersection can be described qualitatively with a range of levels of service (LOS A through LOS F), with LOS A indicating free-flowing traffic and LOS F indicating extreme congestion and long vehicle delays.

The Transportation Element sets the roadway LOS standards for the City of Maple Valley as PM peak hour intersection LOS. The PM peak hour LOS standards are LOS D or better; except for two-way, stop controlled, unsignalized intersections along SR 169, SR 516, or Witte Road which is LOS E for the side street approaches.

Weekday PM peak hour traffic operations for existing and future without-project conditions were evaluated at the study intersections based on the procedures identified in the *Highway Capacity Manual 6th Edition* (2016) and were evaluated using *Synchro 10*. *Synchro 10* is a software program that uses *HCM* methodology to evaluate intersection LOS and average vehicle delays.

**Table 3. PM Peak Hour Intersection LOS - 2035 Update vs Previous 2030 Model**

| | 2035 Update | | | | Previous 2030 Model (from Transportation Element) | | | |
|---|---|---|---|---|---|---|---|---|
| **Intersection** | **Traffic Control** | **LOS[1]** | **Delay[2]** | **WM[3]** | **Traffic Control** | **LOS** | **Delay** | **WM** |
| 1. SR 169 / SE 231st St | Signalized | D | 50 | - | Signalized | D | 50 | - |
| 2. SR 169 / SE Wax Rd | Signalized | C | 31 | - | Signalized | C | 22 | - |
| 3. SR 169 / Witte Rd SE | Signalized | D | 53 | - | Signalized | E | 69 | - |
| 4. Witte Rd SE / SE 240th St | Signalized | C | 30 | - | Signalized | D | 42 | - |
| 5. SR 169 / SE 240th St | Signalized | E | 79 | - | Signalized | E | 57 | - |
| 6. 216th Ave SE / SR 516 | Signalized | C | 24 | - | Signalized | C | 25 | - |
| 7. Witte Rd SE / SR 516 | Signalized | D | 38 | - | Signalized | D | 45 | - |
| 8. 228th Ave SE / SR 516 | Signalized | D | 52 | - | Signalized | D | 49 | - |
| 9. SR 169 / SR 516 | Signalized | F | 82 | - | Signalized | E | 77 | - |
| 10. SR 169 / SE 271st St | Signalized | D | 50 | - | Signalized | D | 42 | - |
| 11. SR 169 / SE 280th St | Signalized | B | 14 | - | Signalized | B | 12 | - |
| 12. SR 169 / SE 244th St | Signalized | A | 6 | - | Signalized | A | 9 | - |
| | Roundabout | A | 5 | WB | - | - | - | - |
| 13. SR 169 / SE 251st St | TWSC | F | 61 | WB | TWSC | F | 82 | WB |
| 14. SR 169 / SE 264th St | Signalized | E | 59 | - | Signalized | D | 55 | - |
| 15. Witte Rd SE / SE 248th St | Roundabout | A | 8 | EB | Roundabout | A | 10 | - |
| 16. Witte Rd SE / SE 254th Pl | TWSC | F | 92 | EB | TWSC | - | - | - |
| | Roundabout | A | 4 | EB | Signalized | A | 4 | - |
| 17. Witte Rd SE / SE 268th St | TWSC | C | 22 | WB | TWSC | C | 21 | WB |
| 18. SR 18 NB Ramps / SE 231st St | Signalized | C | 21 | - | Signalized | C | 24 | - |
| 19. SR 18 SB Ramps / SE 231st St | Signalized | E | 62 | - | Signalized | D | 54 | - |
| 21. SR 169 / SE 276th St | Signalized | B | 13 | - | Signalized | C | 21 | - |
| 25. SE Kent-Kangley Rd / 242nd Ave SE | Signalized | B | 11 | - | Signalized | A | 9 | - |

Note: TWSC = two-way stop-controlled. Signal timing splits optimized under future conditions for all signalized intersections.
1. Level of service, based on Highway Capacity Manual (HCM) 6th Edition (2016) methodology.
2. Average delay in seconds per vehicle.
3. Worst movement reported for unsignalized two-way stop-controlled intersections.

As shown in Table 3, under 2035 during the PM peak hour, 6 intersections are anticipated to operate below LOS D, with 3 intersections at LOS E and 3 intersections at LOS F. Under 2030 conditions as reported in the Transportation Element, 4 intersections are anticipated to operate below LOS D, with 3 intersections at LOS E and 1 intersection at LOS F.

**Intersection Operations at Witte Road and SE 254th Place**

Two traffic control scenarios were evaluated for the Witte Road and SE 254th Place intersection. The first scenario assumed stop control for the SE 254th Place approach. The analysis assumed that both a left-turn lane and right-turn lane would be provided on 254th Place consistent with the funded improvements along Witte Road. Additionally, a left-turn lane and refuge lane were assumed

on Witte Road to allow for northbound vehicles to wait to turn left onto SE 254th Place or to safely merge onto Witte Road. With the planned improved and two-way stop control for the SE 254th Place approach, the intersection is forecast to operate at LOS F by year 2035. As a result, a one-lane roundabout was also evaluated and is anticipated to address the long-term LOS issues at the intersection. A traffic signal was not evaluated for the location since it did not meet future traffic signal warrants. More information on the traffic signal warrant analysis can be found in the attached memorandum dated January 16, 2020.

# 2035 Model Scenario without Residential

The following section summarizes the land use updates and traffic operations analysis assuming no additional residential development will be allowed in the TC/CB and Legacy Site zones in the future.

## *Land Use Forecasts without Residential*

Table 4 summarizes the land use assumptions in the new 2035 travel demand model and compares them to an alternative 2035 model scenario that does not allow additional residential in the TC/CB and Legacy Site zones.

**Table 4. 2035 Update vs 2035 without Residential Land Use Comparison**

| | 2035 Updated Model | | 2035 Updated Model (without Residential) | | Change (without residential) | |
|---|---|---|---|---|---|---|
| **Land Use / Location** | **Residential Units** | **Employees** | **Residential Units** | **Employees** | **Residential Units** | **Employees** |
| Community Business[1] | 754 | 1,437 | 322 | 1,437 | -432 | 0 |
| Regional Employment Center[2] | 2 | 648 | 2 | 648 | 0 | 0 |
| Town Center | 738 | 1,667 | 296 | 1,667 | -442 | 0 |
| Legacy Site | 240 | 365 | 0 | 365 | -240 | 0 |
| Regional Learning and Tech Center | 0 | 583 | 0 | 583 | 0 | 0 |
| City of Black Diamond[3] | 5,964 | 3,781 | 5,964 | 3,781 | 0 | 0 |
| City of Covington[3] | 10,318 | 6,846 | 10,318 | 6,846 | 0 | 0 |

1. CB consists of 8 TAZs at the north end of the City (around SE 240th Street between Witte Road and residential land use by western City limits)
2. REC includes 3 TAZs in the north end of the City, just north of the Community Business district in the vicinity of the 231st Street extension.
3. Does not include entire City, just major developments that are within the travel demand model extents.

As shown in Table 4, the difference between the 2035 model and another scenario without residential is the difference off approximately 1,114 residential units within the City of Maple Valley. In most cases the residential units are assumed to be multi-family units such as apartments or condominiums that would also be associated with portions of retail or other commercial uses. For purposes of the evaluation, no additional land use or commercial activity is assumed to take the place of the reduced residential land uses.

## *Traffic Forecasts*

This section summarizes the PM peak hour traffic forecasts from the updated 2035 Maple Valley travel demand model. Table 5 compares the PM peak hour intersection TEV between the 2035 with residential forecasts and the 2035 without residential forecasts.

**Table 5. PM Peak Hour Intersection Volume - 2035 Update vs 2035 without Residential**

| Intersection | 2035 Update TEV[1] | 2035 without Residential TEV | Change | % Change |
|---|---|---|---|---|
| 1. SR 169 / SE 231st St | 4240 | 4240 | 0 | 0.0% |
| 2. SR 169 / SE Wax Rd | 3760 | 3755 | -5 | -0.1% |
| 3. SR 169 / Witte Rd SE | 3900 | 3860 | -40 | -1.0% |
| 4. Witte Rd SE / SE 240th St | 2405 | 2395 | -10 | -0.4% |
| 5. SR 169 / SE 240th St | 3535 | 3475 | -60 | -1.7% |
| 6. 216th Ave SE / SR 516 | 3165 | 3145 | -20 | -0.6% |
| 7. Witte Rd SE / SR 516 | 3150 | 3145 | -5 | -0.2% |
| 8. 228th Ave SE / SR 516 | 2925 | 2915 | -10 | -0.3% |
| 9. SR 169 / SR 516 | 4180 | 4150 | -30 | -0.7% |
| 10. SR 169 / SE 271st St | 3640 | 3580 | -60 | -1.6% |
| 11. SR 169 / SE 280th St | 2735 | 2725 | -10 | -0.4% |
| 12. SR 169 / SE 244th St | 3255 | 3210 | -45 | -1.4% |
| 13. SR 169 / SE 251st St | 3070 | 2995 | -75 | -2.4% |
| 14. SR 169 / SE 264th St | 3685 | 3640 | -45 | -1.2% |
| 15. Witte Rd SE / SE 248th St | 2075 | 2090 | 15 | 0.7% |
| 16. Witte Rd SE / SE 254th Pl | 1485 | 1485 | 0 | 0.0% |
| 17. Witte Rd SE / SE 268th St | 1400 | 1395 | -5 | -0.4% |
| 18. SR 18 NB Ramps / SE 231st St | 3185 | 3155 | -30 | -0.9% |
| 19. SR 18 SB Ramps / SE 231st St | 3080 | 3060 | -20 | -0.6% |
| 21. SR 169 / SE 276th St | 3080 | 3080 | 0 | 0.0% |
| 25. SE Kent-Kangley Rd / 242nd Ave SE | 1760 | 1780 | 20 | 1.1% |

1. Total Entering Volume during the weekday PM peak hour.

As shown in Table 5, forecasted PM peak hour intersection volumes with and without residential development in TC/CB zones do not change much. Most intersection volumes decrease by less than one percent, with the largest decrease in volumes being 75 vehicles per hour at the intersection of SR 169 and SE 251st Street.

## *Traffic Operations*

Based on the PM peak hour intersection forecast volumes, Table 6 summarizes traffic operations for the future 2035 without Residential scenario compared to the updated 2035 scenario.

**Table 6. PM Peak Hour Intersection LOS - 2035 Update vs 2035 without Residential**

| | 2035 Update | | | | 2035 without Residential | | | |
|---|---|---|---|---|---|---|---|---|
| **Intersection** | **Traffic Control** | **LOS[1]** | **Delay[2]** | **WM[3]** | **Traffic Control** | **LOS** | **Delay** | **WM** |
| 1. SR 169 / SE 231st St | Signalized | D | 50 | - | Signalized | D | 49 | - |
| 2. SR 169 / SE Wax Rd | Signalized | C | 31 | - | Signalized | C | 31 | - |
| 3. SR 169 / Witte Rd SE | Signalized | D | 53 | - | Signalized | D | 48 | - |
| 4. Witte Rd SE / SE 240th St | Signalized | C | 30 | - | Signalized | C | 30 | - |
| 5. SR 169 / SE 240th St | Signalized | E | 79 | - | Signalized | E | 80 | - |
| 6. 216th Ave SE / SR 516 | Signalized | C | 24 | - | Signalized | C | 23 | - |
| 7. Witte Rd SE / SR 516 | Signalized | D | 38 | - | Signalized | D | 38 | - |
| 8. 228th Ave SE / SR 516 | Signalized | D | 52 | - | Signalized | D | 50 | - |
| 9. SR 169 / SR 516 | Signalized | F | 82 | - | Signalized | E | 80 | - |
| 10. SR 169 / SE 271st St | Signalized | D | 50 | - | Signalized | D | 48 | - |
| 11. SR 169 / SE 280th St | Signalized | B | 14 | - | Signalized | B | 13 | - |
| 12. SR 169 / SE 244th St | Signalized | A | 6 | - | Signalized | A | 5 | - |
| | Roundabout | A | 5 | WB | Roundabout | A | 5 | WB |
| 13. SR 169 / SE 251st St | TWSC | F | 61 | WB | TWSC | F | 59 | WB |
| 14. SR 169 / SE 264th St | Signalized | E | 59 | - | Signalized | E | 56 | - |
| 15. Witte Rd SE / SE 248th St | Roundabout | A | 8 | EB | Roundabout | A | 9 | EB |
| 16. Witte Rd SE / SE 254th Pl | TWSC | F | 92 | EB | TWSC | F | 92 | EB |
| | Roundabout | A | 4 | EB | Roundabout | A | 4 | EB |
| 17. Witte Rd SE / SE 268th St | TWSC | C | 22 | WB | TWSC | C | 22 | WB |
| 18. SR 18 NB Ramps / SE 231st St | Signalized | C | 21 | - | Signalized | C | 20 | - |
| 19. SR 18 SB Ramps / SE 231st St | Signalized | E | 62 | - | Signalized | E | 59 | - |
| 21. SR 169 / SE 276th St | Signalized | B | 13 | - | Signalized | B | 13 | - |
| 25. SE Kent-Kangley Rd / 242nd Ave SE | Signalized | B | 11 | - | Signalized | B | 11 | - |

Note: TWSC = two-way stop-controlled. Signal timing splits optimized under future conditions for all signalized intersections.
1. Level of service, based on Highway Capacity Manual (HCM) 6th Edition (2016) methodology.
2. Average delay in seconds per vehicle.
3. Worst movement reported for unsignalized two-way stop-controlled intersections.

As shown in Table 6, the difference in traffic operations between the 2035 update scenario compared the 2035 without residential scenario is minor. All intersections are expected to operate at the same LOS grade except for the intersection of SR 169 and SR 516. This intersection is forecast to operate at LOS F under the 2035 with residential conditions, and at LOS E under the without residential conditions. However, the difference in average vehicle delay between the two scenarios is only 2 seconds at this location since the intersection was right on the LOS E/F threshold. Therefore, the intersection will operate on the cusp of LOS E/F in either scenario.

**Figure 1 - 2035 Maple Valley TAZs**

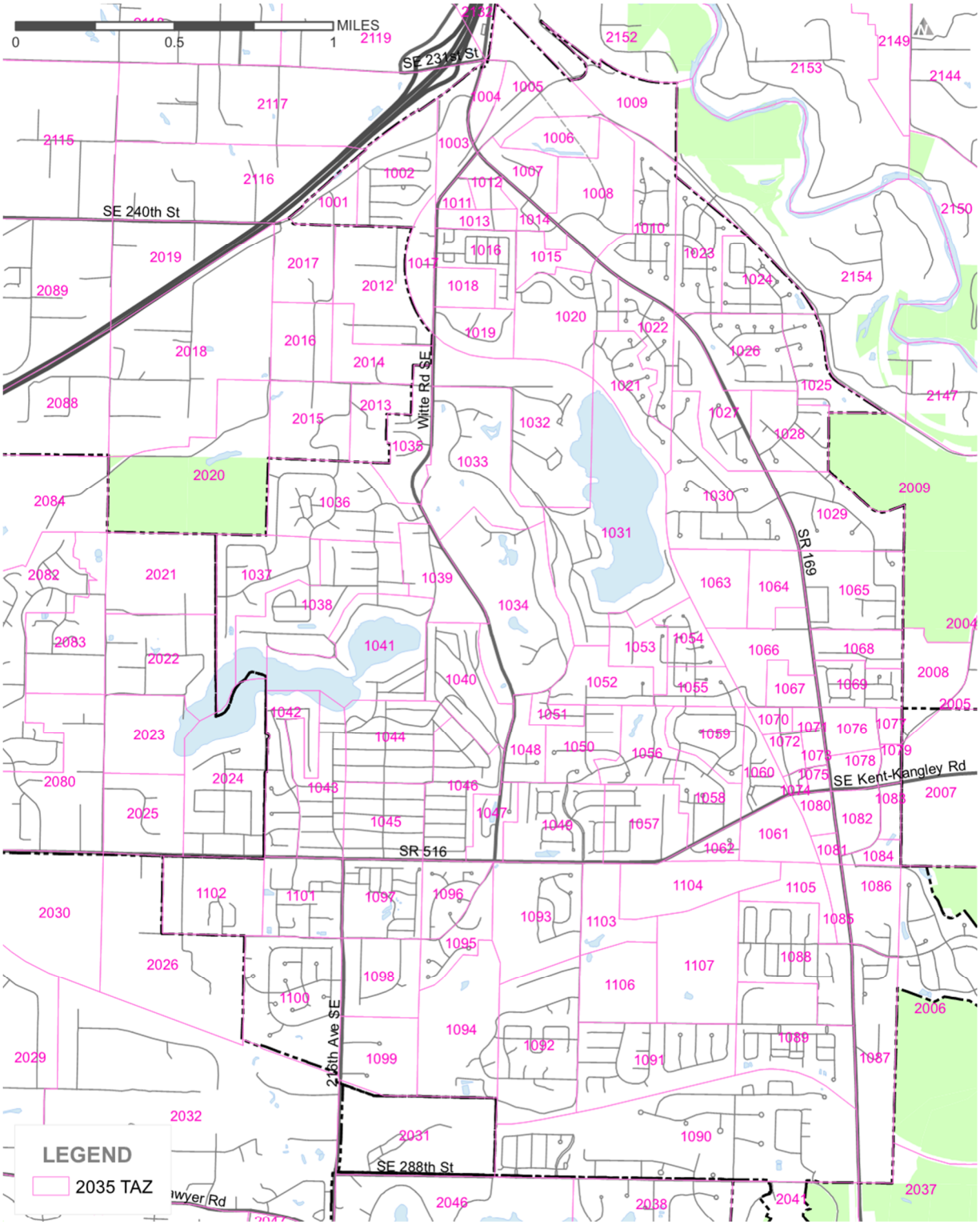
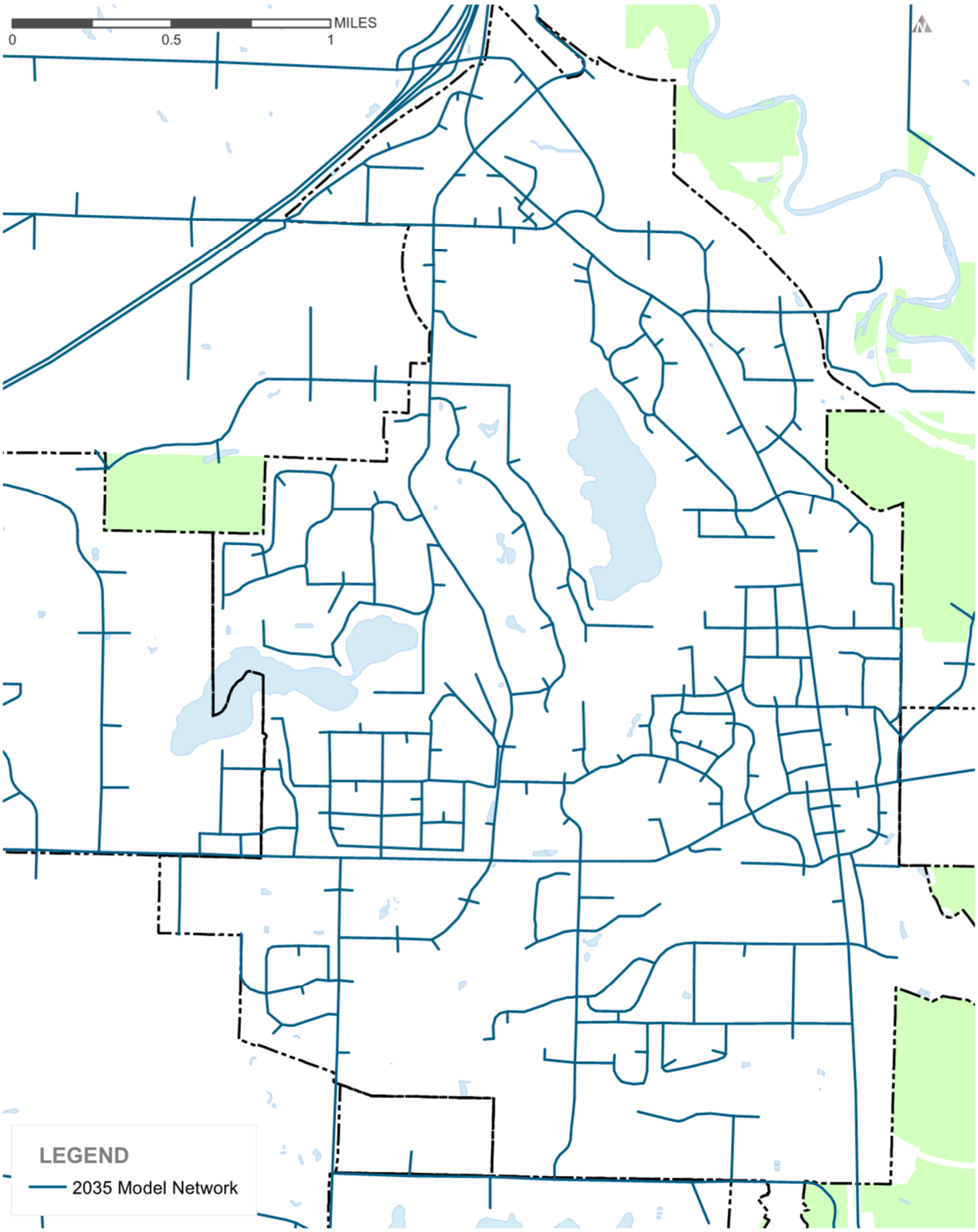


**Figure 2 - 2035 Maple Valley Travel Model Network**



# MEMORANDUM

| | | | |
|---|---|---|---|
| **Date:** | January 16, 2020 | **TG:** | 1.15516.00 - Task 31 |
| **To:** | Tawni Dalziel, PE, City of Maple Valley | | |
| **From:** | Jon Pascal, PE, PTOE, Transpo Group,<br>Walker Cheng, PE, Transpo Group | | |
| **cc:** | David Casey, PE, City of Maple Valley | | |
| **Subject:** | Witte Road / SE 254th Place Intersection Signal Warrant Analysis | | |

This memorandum has been prepared to summarize and present the results of a signal warrant analysis conducted for the intersection of Witte Road and SE 254th Place in the City of Maple Valley. The analysis is based on a future 2025 condition incorporating planned developments and transportation improvements consistent with the City's transportation concurrency program. The analysis indicates none of the signal warrants would be met under the forecast condition, suggesting the installation of a traffic signal at this intersection is not warranted in the near future.

## Introduction

The signal warrant procedures described in the Manual on Uniform Traffic Control Devices (MUTCD) (2009 Edition) provide guidance as to when traffic signals should be installed. For this analysis, two out of nine warrants were reviewed, as the other seven warrants were not applicable for the intersection location.

- Warrant 1, 8-Hour is used to determine if enough volume of vehicles occur for eight or more hours each day, resulting in the need for a traffic signal.
- Warrant 2, 4-Hour is used to determine if minor street traffic volumes are high enough to require the installation of a traffic signal.

A previous signal warrant analysis conducted by the City of Maple Valley evaluated the intersection for Warrant 3, Peak Hour, as included in Appendix A. The evaluation was based on 2013 Existing AM peak hour, 2010 Existing PM peak hour, and 2030 future PM peak hour turning movement volumes. It shows that Warrant 3, Peak Hour was not met under any of the conditions. Additionally, there has been little change to the number of vehicles along the SE 254th Place approach since 2010, that would change the results. Based on the previous evaluation, a traffic signal is not recommended to be installed based on the Peak Hour warrant.

Note that Warrant 3, Peak Hour shall be applied only in unusual cases, such as office complexes that attract or discharge large numbers of vehicles over a short amount of time, as suggested by the MUTCD (2009 Edition). Since the SE 254th Place serves as primary access to a largely residential area, the intersection characteristics are not consistent with the guidance provided by the MUTCD which is reserved for unusual circumstances or trip generators.

## Traffic Forecasts

The future year of 2025 was assumed for the signal warrant analysis to maintain consistency with the future base year of the City's transportation concurrency program. The future turning movement volumes for the intersection were developed in two steps. First, the PM peak hour volumes at the intersection were estimated based on the volumes from nearby intersections at SE 248th Street and SE 264th Street included in the 2025 concurrency model. Next, the PM peak hour forecasts were extrapolated into daily hour-by-hour volumes based on 24-hour directional tube counts. The traffic counts for Witte Road were collected immediately south of this intersection in November 2016, which

are the latest available. The traffic counts for SE 254th Place were collected west of the intersection in January 2020. The traffic counts along Witte Road have not change much since 2016, based on a review of other recent counts in the area. The future 2025 hour-by-hour turning movement volumes used in the analysis are summarized in Appendix B.

# Planned Improvement

The analysis assumes an added left-turn storage lane on SE 254th Place as part of the Witte Road project (T-28b) included in the City of Maple Valley's adopted 2020-2025 Transportation Improvement Program (TIP). The roadway project is currently in the design phase and anticipated to be completed in late 2020.

# Signal Warrant Analysis

A signal warrant analysis was completed for this study intersection following the guidelines and methods presented in the MUTCD (2009 Edition). The signal warrant methodology outlined in this manual provides guidelines as to the conditions when a traffic signal may be necessary. Two of the signal warrant procedures described in the manual were used to determine whether a traffic signal would be warranted by the year of 2025. The two warrants are described in the following sections. Detailed signal warrant worksheets are provided in Appendix C.

## *Warrant 1 – Eight-hour Volumes*

Warrant 1 (eight-hour vehicular volumes) is used to evaluate whether large entering traffic volumes occur at the roadway intersection for a significant portion of an average weekday. Three criteria are used to determine if this warrant is met:

A) Minimum Vehicular Volumes - a large volume of traffic from two intersecting roadways occurs for 8 or more hours, or
B) Interruption of Continuous Traffic - where the traffic volume on a major street is so heavy that traffic on a minor intersecting street suffers excessive delay or conflict in entering or crossing the major street for 8 or more hours, or
C) (80%) Vehicular --and-- Interruption Volumes – where the 80 percent conditions are met for both criteria A) and B).

Results for Warrant 1 are shown in Table 1 and demonstrate that a traffic signal is not warranted under these criteria.

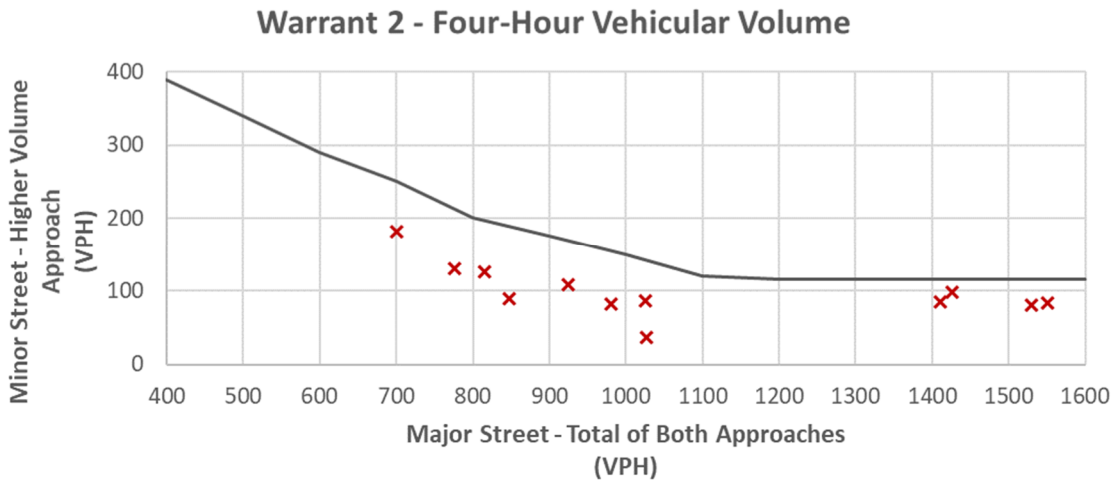
**Table 1. Warrant 1 – Eight-hour Vehicular Volume[1]**

| Criteria | No. Hours Met | Criteria Met? |
|---|---|---|
| A) Minimum Vehicular Volumes | 0 | No |
| B) Interruption of Continuous Traffic | 3 | No |
| C) (80%) Vehicular --and-- Interruption Volumes | 1 | No |

1. Warrant 1 is used to evaluate whether large entering traffic volumes occur at the roadway intersection for a significant portion (8 hours) of the day.

### *Warrant 2 – Four-hour Volumes*

Warrant 2 (four-hour vehicular volumes) is used to evaluate whether large conflicting traffic volumes occur at the roadway intersection and create a large number of vehicular conflicts. To meet this warrant, four or more hours during an average weekday must fall on or above the line shown in the following chart. The results indicate that under Warrant 2 criteria, a traffic signal is not warranted at the study intersection.




### *Sensitivity Test to Estimate When a Signal Might Be Warranted*

As discussed above, neither of the two evaluated warrants would be met under the 2025 forecast condition. For either warrant to be met, volumes on both the major and minor street need to exceed the corresponding thresholds within the same hour. Based on the forecast 2025 condition, volume along Witte Road would mostly exceed the upper threshold. It is mainly the relatively low volume from SE 254th Place that falls under the threshold volumes.

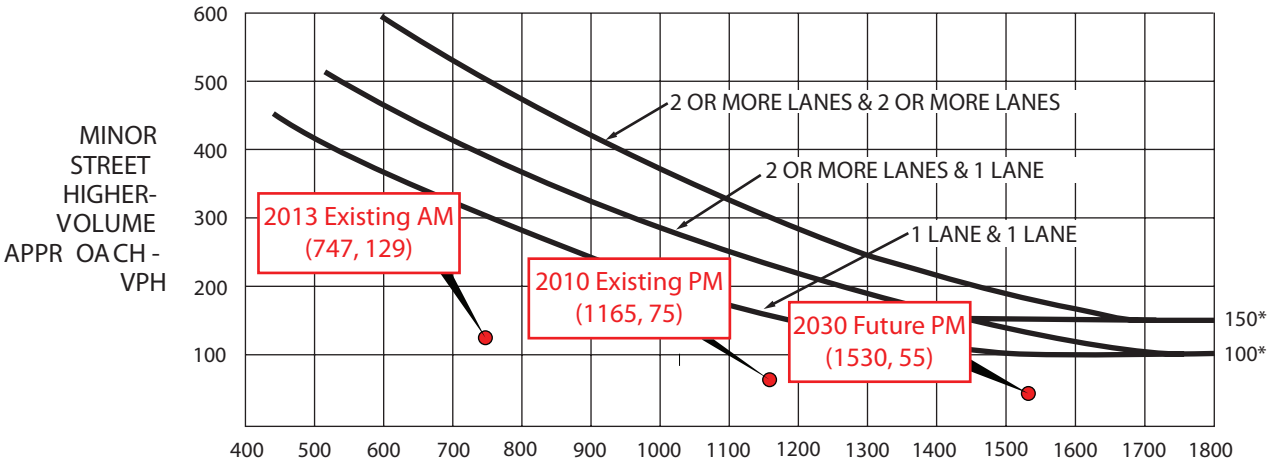
A sensitivity test was conducted to estimate the amount of vehicle growth on SE 254th Place that would need to occur to trigger a signal warrant. The sensitivity test indicates Warrant 1 – Eight-hour Vehicular Volume would first be triggered if the vehicle volumes grew another 20 percent along SE 254th Place. This is equivalent to approximately 20 more vehicles during the PM peak hour, or trips generated by roughly 65 new single-family dwelling units.

# Appendix A: Peak Hour Warrant

# WITTE ROAD ANALYSIS
# Witte Road / SE 254th Place
# Peak Hour Volumes



Figure 4C-3. Warrant 3, Peak Hour




*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

# Appendix B: 2025 Forecast Volumes

Witte Rd/SE 254th Pl

**2025 Baseline**

| Time | EB | | | | WB | | | | NB | | | | SB | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | LT | Th | RT | Approach | LT | Th | RT | Approach | LT | Th | RT | Approach | LT | Th | RT | Approach |
| 7:00 AM | 18 | 2 | 16 | 36 | 1 | 0 | 0 | 1 | 1 | 762 | 10 | 773 | 1 | 251 | 2 | 254 |
| 8:00 AM | 41 | 5 | 36 | 82 | 2 | 0 | 0 | 2 | 1 | 617 | 8 | 626 | 2 | 350 | 3 | 355 |
| 9:00 AM | 65 | 8 | 57 | 130 | 2 | 0 | 0 | 2 | 6 | 397 | 5 | 408 | 2 | 353 | 13 | 368 |
| 10:00 AM | 91 | 11 | 79 | 181 | 2 | 0 | 0 | 2 | 16 | 338 | 4 | 358 | 2 | 305 | 36 | 343 |
| 11:00 AM | 63 | 8 | 55 | 126 | 2 | 0 | 0 | 2 | 19 | 339 | 4 | 362 | 2 | 409 | 42 | 453 |
| 12:00 PM | 54 | 7 | 47 | 108 | 2 | 0 | 0 | 2 | 22 | 372 | 5 | 399 | 2 | 475 | 49 | 526 |
| 1:00 PM | 44 | 6 | 39 | 89 | 2 | 0 | 0 | 2 | 31 | 323 | 4 | 358 | 2 | 419 | 68 | 489 |
| 2:00 PM | 44 | 5 | 38 | 87 | 3 | 0 | 0 | 3 | 32 | 364 | 5 | 401 | 3 | 550 | 71 | 624 |
| 3:00 PM | 43 | 5 | 37 | 85 | 4 | 0 | 0 | 4 | 42 | 436 | 6 | 484 | 4 | 829 | 93 | 926 |
| 4:00 PM | 42 | 5 | 37 | 84 | 5 | 0 | 0 | 5 | 35 | 459 | 6 | 500 | 5 | 969 | 77 | 1,051 |
| 5:00 PM | 40 | 5 | 35 | 80 | 5 | 0 | 0 | 5 | 55 | 385 | 5 | 445 | 5 | 960 | 120 | 1,085 |
| 6:00 PM | 49 | 6 | 43 | 98 | 4 | 0 | 0 | 4 | 71 | 356 | 5 | 432 | 4 | 835 | 155 | 994 |

# Appendix C: Signal Warrant Evaluation Worksheets

# Warrants Volume

## Information

| | | | |
|---|---|---|---|
| Analyst | Transpo Group | Intersection | Witte Rd/SE 254th Pl |
| Agency/Co | | Jurisdiction | Maple Valley |
| Date Performed | 1/10/2020 | Units | U.S. Customary |
| Project ID | 15516 Task 31 | Time Period Analyzed | Baseline 2025 |
| East/West Street | SE 254th Place | North/South Street | Witte Road |
| File Name | Witte Rd-SE 254th Pl Baseline Warrant - LT Warrant.xhy | Major Street | North-South |

Project Description *15516 Task 31*

## *Warrant 1*

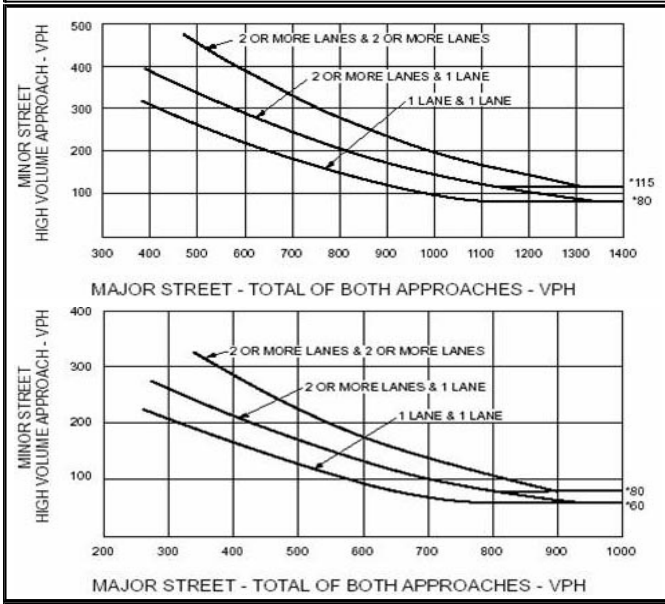
**Condition A—Minimum Vehicular Volume**

| Number of lanes for moving traffic on each approach | | Vehicles per hour on major street (total of both approaches) | | | | Vehicles per hour on higher-volume minor-street approach (one direction only) | | | |
|---|---|---|---|---|---|---|---|---|---|
| Major Street | Minor Street | 100% | 80% | 70% | 56% | 100% | 80% | 70% | 56% |
| 1 | 1 | 500 | 400 | 350 | 280 | 150 | 120 | 105 | 84 |
| 2 or more | 1 | 600 | 480 | 420 | 336 | 150 | 120 | 105 | 84 |
| 2 or more | 2 or more | 600 | 480 | 420 | 336 | 200 | 160 | 140 | 112 |
| 1 | 2 or more | 500 | 400 | 350 | 280 | 200 | 160 | 140 | 112 |

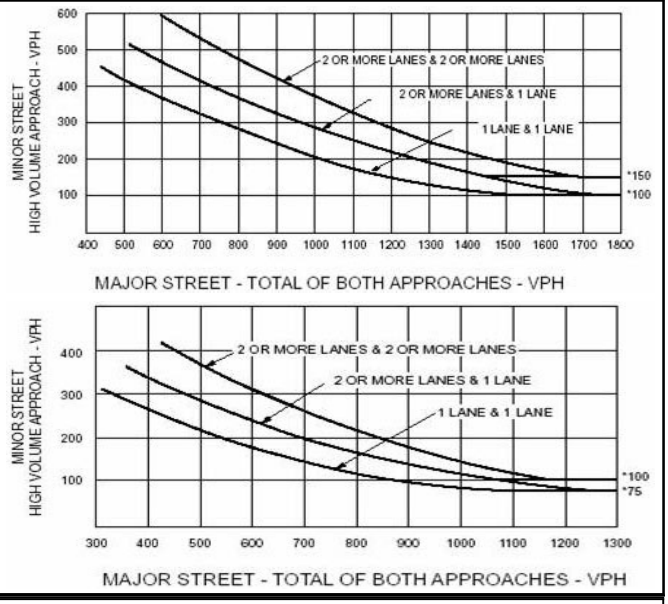
**Condition B—Interruption of Continuous Traffic**

| Number of lanes for moving traffic on each approach | | Vehicles per hour on major street (total of both approaches) | | | | Vehicles per hour on higher-volume minor-street approach (one direction only) | | | |
|---|---|---|---|---|---|---|---|---|---|
| Major Street | Minor Street | 100% | 80% | 70% | 56% | 100% | 80% | 70% | 56% |
| 1 | 1 | 750 | 600 | 525 | 420 | 75 | 60 | 53 | 42 |
| 2 or more | 1 | 900 | 720 | 630 | 504 | 75 | 60 | 53 | 42 |
| 2 or more | 2 or more | 900 | 720 | 630 | 504 | 100 | 80 | 70 | 56 |
| 1 | 2 or more | 750 | 600 | 525 | 420 | 100 | 80 | 70 | 56 |

## *Warrant 2*




## *Warrant 3*




## *Volume Summary*

**Major Street Lanes** 1 **Minor Street Lanes** 2+ **Speed** 35 **Population** 10000+

| Hours | Major Volume | Minor Volume | Total Volume | 1A (100%) | 1A (80%) | 1B (100%) | 1B (80%) | 2 (100%) | 3A (100%) | 3B (100%) |
|---|---|---|---|---|---|---|---|---|---|---|
| 07-08 | 1027 | 36 | 1064 | No | No | No | No | No | No | No |
| 08-09 | 981 | 82 | 1065 | No | No | No | Yes | No | No | No |
| 09-10 | 776 | 130 | 908 | No | No | Yes | Yes | No | No | No |
| 10-11 | 701 | 181 | 884 | No | Yes | No | Yes | No | No | No |
| 11-12 | 815 | 126 | 943 | No | No | Yes | Yes | No | No | No |
| 12-13 | 925 | 108 | 1035 | No | No | Yes | Yes | No | No | No |
| 13-14 | 847 | 89 | 938 | No | No | No | Yes | No | No | No |
| 14-15 | 1025 | 87 | 1115 | No | No | No | Yes | No | No | No |
| 15-16 | 1410 | 85 | 1499 | No | No | No | Yes | Yes | No | No |
| 16-17 | 1551 | 84 | 1640 | No | No | No | Yes | Yes | No | No |
| 17-18 | 1530 | 80 | 1615 | No | No | No | Yes | No | No | No |
| 18-19 | 1426 | 98 | 1528 | No | No | No | Yes | Yes | No | No |
| Totals | 13014 | 1186 | 14234 | 0 | 1 | 3 | 11 | 3 | 0 | 0 |

# Warrants Summary

**Information**

| | | | |
|---|---|---|---|
| Analyst | Transpo Group | | |
| Agency/Co | | Intersection | Witte Rd/SE 254th Pl |
| Date Performed | 1/10/2020 | Jurisdiction | Maple Valley |
| Project ID | 15516 Task 31 | Units | U.S. Customary |
| East/West Street | SE 254th Place<br>Witte Rd-SE 254th Pl | Time Period Analyzed | Baseline 2025 |
| | | North/South Street | Witte Road |
| File Name | Baseline Warrant - LT Warrant.xhy | Major Street | North-South |

Project Description *15516 Task 31*

| General | | | | Roadway Network | |
|---|---|---|---|---|---|
| Major Street Speed (mph) | 35 | ☐ | Population < 10,000 | Two Major Routes | ☐ |
| Nearest Signal (ft) | 6000 | ☐ | Coordinated Signal System | Weekend Count | ☐ |
| Crashes (per year) | 0 | ☐ | Adequate Trials of Alternatives | 5-yr Growth Factor | 0 |

| ***Geometry and Traffic*** | EB | | | WB | | | NB | | | SB | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | LT | TH | RT | LT | TH | RT | LT | TH | RT | LT | TH | RT |
| Number of lanes, N | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 |
| Lane usage | L | TR | | | LTR | | | LTR | | | LTR | |
| Vehicle Volume Averages (vph) | 49 | 6 | 43 | 2 | 0 | 0 | 27 | 429 | 5 | 2 | 558 | 60 |
| Peds (ped/h) / Gaps (gaps/h) | -- | 0 / 0 | -- | -- | 0 / 0 | -- | -- | 0 / 0 | -- | -- | 0 / 0 | -- |
| Delay (s/veh) / (veh-hr) | -- | 0 / 0 | -- | -- | 0 / 0 | -- | -- | 0 / 0 | -- | -- | 0 / 0 | -- |

| | |
|---|---|
| ***Warrant 1: Eight-Hour Vehicular Volume*** | ☐ |
| 1 A. Minimum Vehicular Volumes (Both major approaches --and-- higher minor approach) --or-- | ☐ |
| 1 B. Interruption of Continuous Traffic (Both major approaches --and-- higher minor approach) --or-- | ☐ |
| 1 (80%) Vehicular --and-- Interruption Volumes (Both major approaches --and-- higher minor approach) | ☐ |
| ***Warrant 2: Four-Hour Vehicular Volume*** | ☐ |
| 2 A. Four-Hour Vehicular Volumes (Both major approaches --and-- higher minor approach) | ☐ |
| ***Warrant 3: Peak Hour*** | ☐ |
| 3 A. Peak-Hour Conditions (Minor delay --and-- minor volume --and-- total volume ) --or-- | ☐ |
| 3 B. Peak- Hour Vehicular Volumes (Both major approaches --and-- higher minor approach) | ☐ |
| ***Warrant 4: Pedestrian Volume*** | ☐ |
| 4 A. Four Hour Volumes --or-- | ☐ |
| 4 B. One-Hour Volumes | ☐ |
| ***Warrant 5: School Crossing*** | ☐ |
| 5. Student Volumes --and-- | ☐ |
| 5. Gaps Same Period | ☐ |
| ***Warrant 6: Coordinated Signal System*** | ☐ |
| 6. Degree of Platooning (Predominant direction or both directions) | ☐ |
| ***Warrant 7: Crash Experience*** | ☐ |
| 7 A. Adequate trials of alternatives, observance and enforcement failed --and-- | ☐ |
| 7 B. Reported crashes susceptible to correction by signal (12-month period) --and-- | ☐ |

| | |
|---|---|
| 7 C. (80%) Volumes for Warrants 1A, 1B --or-- 4 are satisfied | ☑ |
| ***Warrant 8: Roadway Network*** | ☐ |
| 8 A. Weekday Volume (Peak hour total --and-- projected warrants 1, 2 or 3) --or-- | ☐ |
| 8 B. Weekend Volume (Five hours total) | ☐ |
| ***Warrant 9: Grade Crossing*** | ☐ |
| 9 A. Grade Crossing within 140 ft --and-- | ☐ |
| 9 B. Peak-Hour Vehicular Volumes | ☐ |